

9th International Conference on EcoBalance (9th ICEB)—towards and beyond 2020, November 9–12, 2010, Tokyo, Japan

Keisuke Nansai · Yuki Kudoh · Hiroki Hondo · Kiyotada Hayashi ·
Kazuyo Matsubae · Kenichi Nakajima · Shinsuke Murakami · Masaharu Motoshita ·
Seiji Hashimoto · Minako Hara · Michiyasu Nakajima · Rokuta Inaba ·
Yasunari Matsuno · Yoshikazu Shinohara

Received: 1 March 2011 / Accepted: 17 March 2011 / Published online: 19 April 2011
© Springer-Verlag 2011

1 Introduction

The 9th International Conference on EcoBalance (ICEB), organized by the Institute of Life Cycle Assessment, Japan (ILCAJ) and co-organized by the Ecomaterials Forum and Life Cycle Assessment Society of Japan, was held on November 9–12, 2010 in Tokyo, Japan. The main theme of the conference was “Towards & Beyond 2020”, with the aim of discussing problems and solutions in various fields such as energy, resources, food, water, transportation and consumer lifestyle to clarify what needs to be done towards and beyond 2020 to ensure a sustainable future.

The ICEB began in 1994 as a biennial conference to address life cycle assessment (LCA) but has since evolved

into a forum to discuss the development and application of methods for steering and measuring sustainability based on life-cycle thinking. To date, the conference has attracted many participants from all over the world working in academia, industry and government.

As in previous years, attendance was high, with as many as 380 people from Japan and abroad participating in the 9th ICEB. There were policy leaders, business specialists and consultants, as well as researchers from universities and academic research institutes. Of those attending, 147 were from 28 overseas regions and nations, of whom 57 from non-OECD countries. Attendance was as follows: Germany (19), Taiwan (16), Thailand (16), South Korea (14), USA (14), China (11), Australia (six), Finland (five), Italy (five),

K. Nansai (✉) · K. Nakajima · S. Hashimoto · R. Inaba
Research Center for Material Cycles and Waste Management,
National Institute for Environmental Studies (NIES),
16-2 Onogawa,
Tsukuba, Ibaraki 305-8506, Japan
e-mail: nansai.keisuke@nies.go.jp

Y. Kudoh · M. Motoshita
National Institute of Advanced Industrial
Science and Technology (AIST),
Tsukuba, Japan

H. Hondo
Chair of the Executive Committee of the 9th ICEB,
Yokohama National University,
Yokohama, Japan

K. Hayashi
National Agriculture and Food Research Organization (NARO),
Tsukuba, Japan

K. Matsubae
Tohoku University,
Tohoku, Japan

S. Murakami · Y. Matsuno
University of Tokyo,
Tokyo, Japan

M. Hara
NTT Energy and Environment Systems Laboratories,
Kanagawa, Japan

M. Nakajima
Kansai University,
Kansai, Japan

Y. Shinohara
National Institute for Materials Science (NIMS),
Tsukuba, Japan

Switzerland (five), France (four), Saudi Arabia (four), United Arab Emirates (four), Spain (three), Sweden (three), Canada (two), Malaysia (two), New Zealand (two), Norway (two), The Netherlands (two), Austria (one), Belgium (one), Czech Republic (one), Hong Kong (one), India (one), Indonesia (one), Singapore (one) and UK (one). From Japan, 233 people participated. Of these, 51 were foreign students and researchers affiliated with Japanese universities and research institutes, with 24 participants from non-OECD nations. With non-OECD citizens being charged discounted participation fees for the first time, attendance from non-OECD countries was higher than at previous ICEB conferences. This suggests that although ICEB will be held primarily in Asia in the future, specialists with a shared background in lifecycle thinking from all over the world should attend this conference to obtain information on cutting edge and workable research outcomes.

At the conference, two keynote lectures, 137 oral presentations and 112 poster presentations were given. As Table 1 shows, the oral presentations consisted of eight special sessions and 10 general sessions, comprising 82 and 55 presentations of research papers, respectively. In the special sessions, debate focused on the following issues: biomass resources, urban mining, water footprint, decoupling of Asia, sustainability indicators, assessment

of new technologies, material flow cost accounting, and ecomaterials. At these sessions, future tasks and research foresight were actively debated on the basis of reports on state-of-the-art studies.

This paper presents an outline of the keynote lectures and special sessions as well as the opening and closing ceremonies.

2 Opening ceremony

At the opening ceremony, Hiroki Hondo (Yokohama Nat. Univ.), Chair of the Organizing Committee, made some broad opening remarks. He introduced the goal of “Towards and Beyond 2020”, the guiding theme of the conference, stressing the need to promote new modes of decision-making today in order to create a society 10 years hence that can look forward to a sustainable future. He also referred to the importance of decision-making based on lifecycle thinking in connection with the various trade-offs that need to be made in society and reconfirmed the need to grasp the direct and indirect environmental and socioeconomic consequences of policy decisions in their geographical as well as temporal ramifications.

Table 1 Session titles and number of presentations at each session

Session categories	Title	Number of presentations
Plenary session	Keynote lectures 1 and 2	2
Oral special session	Sustainable management of agricultural and biomass resources using the life cycle approach	24
	Sustainable mining from natural and urban reserves	13
	Advances of knowledge for assessing water resource use and consumption in LCA	4
	Decoupling environmental impact and resource use from economic growth in Asia	8
	Index and methods to assess socio-economic impacts and sustainability	5
	International standardization of environmental management accounting	5
	Applications of LCA to new-technology innovation	13
	Materials for raising consumer environmental awareness and promoting consumer environmental practices	10
Oral general session	Theory and practice of supply chain analysis	4
	Design for sustainable transport	3
	Life cycle thinking on building	4
	Resource and environment in Asia	7
	Lifestyle and consumption	4
	International trade and waste management issues	4
	Carbon resource management in energy systems	4
	New topics in LCA databases	15
	Environmental education for life cycle thinking	5
	Risk assessment and management	5
Poster session		112
Total		251

Next, Matthias Finkbeiner (Technical Univ. Berlin), Chair of the International Advisory Board, stated in his words of greeting that our community, participating in the 9th ICEB, needs to provide empirically based methodologies and tools for charting the way to a sustainable future. In this context, the development of “lifecycle-based sustainability assessment methods” is of vital importance.

Atsushi INABA (Kogakuin Univ.), President of ILCAJ, explained that although carbon footprinting of commodities and firms is attracting the attention of a variety of actors concerned with environmental issues, these are mainly academic, conventional LCA studies of GHGs (greenhouse gases), and it is now time for the LCA community to propose a new concept for use as a “Real tool for business”. It is important to improve the applicability of LCA in the real world, he stated, particularly in business, as to date, LCA has been developed in academic circles.

3 Plenary session

3.1 Keynote 1: how should we shape our future? Beyond a low-carbon society

Shinji Tarutoko, a member of the Japanese House of Representatives, gave the first keynote lecture, entitled “How should we shape our future? Beyond a low-carbon society”. In 2009, he was appointed Chair of the Standing Committee on Environment of the House of Representatives and in that capacity devoted himself to formulating environmental policy in Japan until June 2010.

In his lecture, Tarutoko stated that climate-change problems are currently the most significant issues in global society and that nations unable to respond to these issues will sooner or later decline. In order for Japan to establish an honourable position in the world, these issues need to be firmly addressed. It generally takes people many years to change their mindset, and it has taken about 20 years for the climate-change issue to come to prominence globally. In Japan, this time lag in changing popular opinion has influenced the formulation of policies to address climate change. A proposal (“Japan will aim to reduce its emissions by 25% by 2020, compared to the 1990 level”) by former Prime Minister Hatoyama presented in September 2009 at the United Nations could in principle contribute to promoting a change in thinking.

Because climate change issues need to be addressed over an extended period of 20 to 50 years, it is indispensable for strategies in this realm to be compatible with economic activities. From a historical perspective, economic progress is intimately linked with technological innovation. Nevertheless, to date, technical innovation has been promoted mainly in the pursuit of convenience, particularly in Japan.

From now on, technological innovation in the energy field needs to proceed from the finiteness of resources, and its influence on society will be substantial. Japan must, therefore, play its part in reducing global carbon emissions, and it is currently establishing a policy framework for promoting this issue. Unless Japan remains a world leader in technological innovation, however, it will be unable to contribute to overseas emissions abatement. In Japan, where the required emissions cuts are very costly, every effort must be made to reduce domestic emissions by every means available, including promotion of society-wide use of low-carbon technologies.

Tarutoko also referred to the need for a new framework for emissions trading that does not hamper technical innovation, based on capping the lifecycle emissions of commodities, rather than the conventional framework of capping at individual manufacturing sites. He also stated that improvements in the research field of LCA, such as framework designing and calculation methods, are highly anticipated. Finally, he concluded that if the economy is to remain compatible with environmental requirements, technical innovation should be promoted as a matter of priority and frameworks in Japan and elsewhere should be streamlined to that end, which requires a change of mindset. Penetration of the lifecycle concept in society at large might make a major contribution to achieving this aim.

3.2 Keynote 2: chemical risk management and the greenhouse effect

The second keynote lecture, on chemical risk management in the context of the greenhouse effect, was given by Junko Nakanishi, Director of the Research Institute of Science for Safety and Sustainability, AIST, Japan. She emphasized the importance of quantifying and comparing various environmental risks for formulating appropriate environmental policies. For her outstanding achievements, on November 4, 2010 she was designated a “Person of Cultural Merit” by the Japanese government.

In her lecture, Nakanishi first stated that 2009 can be considered the year that Japan embarked on risk management of chemical substances. This is because the Chemical Substances Control Act, the law addressing the toxicity of general chemical substances, was fundamentally amended in April 2009, shifting its focus from hazard-based to risk-based regulation. With this amendment in place, risk assessment of chemicals and control based on the evaluated risk are expected to be widely applied in Japan.

In the new situation, with regulation based on risk rather than hazard, the key issue in managing chemical substances is to give due consideration to risk trade-off. As a typical example of failure in this respect, the ban on the use of dichloro-diphenyl-trichloroethane was described. The han-

dling of a risk trade-off requires consideration of multiple risks, which means comparing different types of risk. Some 20 years ago, Nakanishi proposed a framework to this end, enabling comparisons encompassing costs, human health risks and ecological risks.

Next, Nakanishi described the importance of risk trade-off in measures to combat global warming, with reference to a case study on refrigerants. If the refrigerant used in vehicle air conditioners is assessed on its own according to its global warming potential (GWP), for example, then the use of CO₂ as a refrigerant is deemed favourable. In this case, however, the lifecycle CO₂ emissions of cars will increase. If an integral assessment is made, on the other hand, use of R-1234yf (CF₃CF = CH₂) will be deemed preferable, even though its GWP is higher than that of CO₂. As another example, she took a refrigerant used in an indoor air conditioner and explained that in risk management, it is not always enough to opt for the alternative giving the maximum attainable reduction. She then stressed that the alternative should be cost-effective within a range given by individual risk being suppressed to the de minimis risk and by abatement obligations under treaties and suchlike being duly fulfilled. In conclusion, she reiterated the following key points: (1) in selecting the best substitute among alternatives, it is the total risk that needs to be evaluated. (2) The greater the decrease in *overall* risk through substitution, the better. (3) To select a substitute means considering more than just the total risk, however. (4) Attention also needs to be paid to cost-effectiveness and obligations relating to the total amount of risk reduced by external factors like international agreements. (5) Finally, the relationship between each risk and each pertinent regulation needs to be duly considered. For this purpose, the idea of de minimis risk would be useful.

4 Summary of oral special sessions

As stated earlier, the oral presentations consisted of eight special sessions and 10 general sessions. The following provides an outline of the contents of the special sessions.

4.1 Special session 1: sustainable management of agricultural and biomass resources using the life cycle approach

Sustainable production and use of agricultural and biomass resources is recognized as a key issue in satisfying future human dietary requirements and reducing fossil fuel consumption in energy and material production chains. In this context, the environmental impacts of land use, land use change and forestry (LULUCF) and the depletion of natural resources for fertilizer production need to be duly

examined, as well as feedstock production and use as food, energy and materials. The aim of this special session, organized by Yuki Kudoh (AIST), Kiyotada Hayashi (NARO) and Kazuyo Matsubae (Tohoku Univ.), is to discuss various evaluation methods, results and issues relating to sustainable agricultural and biomass resources from the lifecycle perspective. Among the issues discussed were sustainable agriculture and food production; bioenergy production and use; biorefineries; the agro-industrial complex; utilization of agriculture residues and wastes; carbon release and stocks in the context of LULUCF; ecosystem services and biodiversity; MFA/SFA of mineral nutrition balances and resource-saving technological development. A total of 24 presentations from nine countries were given at six sessions, including eight invited speakers, whose summaries are as follows.

Roland W. Scholz (ETH Zurich) presented his integrated perspective on the difference between attributional and consequential LCA and hypothesized that there may be major differences in environmental assessment, depending on which approach is adopted. He sketched an analysis of feedback loops resulting from the Swedish “Go for Bioethanol” decision, made within the framework of the national strategy “Oil-free society by 2020”.

Bastian Wittstock (Univ. of Stuttgart), the second invited speaker in this session, presented the Land Use Indicator Calculation Tool approach, which permits calculation of land-use indicator values for specific land-intensive activities. He demonstrated the usefulness of the approach using six case studies of biofuel feedstock production in Japan and discussed how to develop the data acquisition guideline for the approach.

Lise Laurin (EarthShift, LLC) analyzed the costs and benefits of Japanese investments in biofuels production to determine whether the projects are sustainable using total cost assessment, which allows the enumeration of uncertain events, giving a financial picture of the future of a decision that includes best-case, worst-case and most probable ranges of return on investment.

Rolf Frischknecht (ESU-services Ltd.) gave a talk about the development of the ecological scarcity method for the Japanese situation, which is an adaptation of the most recent Swiss Eco-Factor 2006 method and demonstrated its application to energy-crop production in Japan. The results show that improved cultivation techniques can help reduce the environmental burden of Japanese agricultural activities.

Evan M. Griffing (Environmental Clarity, LLC) presented life cycle inventory data for fertilizer production, particularly addressing six fertilizer chemicals: ammonium chloride, ammonium sulphate, ammonium phosphate, ordinary and triple superphosphates and potassium chloride. He also compared the results obtained using the Environmental Clarity and Ecoinvent LCI methods.

David A. Vaccari (Stevens Institute of Technology) gave a talk on the current situation regarding global supply and demand of phosphate ore. Peak phosphate ore supply was discussed in terms of its robustness and fit with model projections.

Hisao Ohtake (Osaka Univ.) discussed phosphorus recovery and recycling technologies. He focused on phosphorus recycling from sewage sludge as well as incineration ash and explained the potential of this secondary phosphorus resource. He described national promotion of phosphorus recycling in Japan.

Shabbir H. Gheewala (King Mongkut's Univ. of Technology) described his experience drawn from studies conducted on energy and environmental assessment using the life cycle approach (sugarcane, oil palm and *Jatropha*) and pointed out the importance of efficient utilization of by-products for sustainable utilization of biomass resources. His conclusions show that to properly evaluate so-called biorefineries, which integrate the bioconversion process to produce fuels and power with production of value-added chemicals from biomass, it is imperative to use an integrated approach such as life cycle assessment to capture trade-offs between the various life cycle stages.

4.2 Special session 2: sustainable mining from natural and urban reserves

Even with strong efforts towards dematerialization, demand for materials continues to rise. However, the supply of natural resources remains fragile. While recognizing the unchanging importance of natural-ore mining, we should be devoting more attention to “urban mining”. This session, organized by Kenichi Nakajima (NIES) and Shinsuke Murakami (Univ. of Tokyo), aimed to explore our experience in mining and materials science and expand our knowledge of sustainable resource management. Research studies investigating sustainable mining and resource use were presented, including topics from mineral economics, materials science, environmental studies, material flow and stock accounting and LCA. To stimulate discussions, the 12 speakers, including three invited speakers, described their recent research and introduced the current situation in the various industries.

At the first session, the invited speaker Hwong-wen Ma (Nat. Taiwan Univ.) discussed the material flow of zinc associated with the steel cycle in Taiwan. Zinc is widely used as an industrial metal, above all for the galvanization of steel products. Despite the difficulty of zinc recycling, electric arc furnace (EAF) dust presently plays an important role in zinc recovery from end-of-life products. Intermediate dust treatment processes such as the Waelz process are, therefore, key technologies for promoting a limited zinc

cycle. The present status of EAF dust management for zinc recovery in Taiwan was also discussed.

At the second session, the invited speaker Takashi Nakamura (Tohoku Univ.) reported on the scope for recycling cathode-ray tubes (CRT) in a lead smelter from an environmental perspective. This is the most straightforward method for recycling the CRT glass back into CRT glass. However, diminishing demand has led to stoppage of domestic production of CRT TVs and export to Asian countries, which may soon lead to an end to imports. One possible solution is processing in lead smelters. Nakamura then introduced and analyzed the current Japanese situation, while information on the European situation was provided from the floor. Hiroshi Shimotori (JOGMEC: Japan Oil, Gas and Metals National Corp.) introduced their efforts towards preventing mine pollution at both operational and abandoned mines. Acid mine drainage has become a major concern in mining industries and has compelled the Japanese government to address the issue, as many mining companies ceased to operate following closure of their mines.

At the third session, the invited speaker Sangwon Suh (Univ. of California Santa Barbara) reported on a hybrid Goshian framework for mapping industrial metal flow networks. The usefulness of a Goshian framework as an economic model has been at best questionable in the field of input–output analysis. In the study concerned, use was made of a mixed-unit Goshian framework and combined input–output and process-specific data from a survey of individual facilities. The approach was used to analyze the flow of five metals using Korean data: lead, zinc, manganese, aluminium and molybdenum.

4.3 Special session 3: advance of knowledge for assessing water resource use and consumption in LCA

As with many other biotic and abiotic resources, water is an essential resource for all living beings. Because water is characterised as a renewable resource, in LCA activities in the past the consumption of water resources has not been addressed as carefully as deserved. Recently, though, projections of growth in water demand based on population and economic growth figures have been focusing minds on the assessment of water use/consumption in LCA studies, with introduction of the concept of “water footprint”. In this context, this special session, organized by Masaharu Motoshita (AIST), sought to share the advanced and latest activities relating to this topic and discuss the work that needs to be done and the desired direction of our activities for assessing water consumption in LCA. Because water consumption has become such a topic of interest, we were able to have seven presentations from as many different countries, including four poster spotlight presentations.

Annette Koehler (ETH Zurich), the invited speaker of this special session, gave a comprehensive introduction to activities on inventory analysis and impact assessment and identified the gaps between existing methodology and practical applicability. Although several different indices and tools have already been developed for inventory analysis and impact assessment, gaps remain between the information provided in LCI and that required for LCIA. On its own, quantitative data on water input is insufficient for assessing water consumption, for example, and other information (like off-stream/in-stream, use/consumption, type of water resource, geographic location) is indispensable for precise assessment of the associated environmental impacts. LCI and LCIA methodologies should be harmonized by balancing them with the increased difficulty of data collection in LCI.

Regarding the development of tools for LCI, the development of water footprint databases in different countries based on input–output models was presented by Jing Liu (Waseda Univ.) for China and Yuka Ono (Tokyo City Univ.) for Japan. Human health damage assessment methodology related to agricultural water consumption and impacts on terrestrial ecosystems attributable to milk production in Peru were presented by Motoshita (AIST) and Francesca Verones (ETH Zurich), respectively, as impact assessment methodologies for water consumption. As practical activities, two case studies of LCA for water supply systems were introduced: a rainwater harvesting system by Ramon Farreny (Univ. Autònoma of Barcelona) and irrigation facilities by Young Deuk Kim (Rural Research Institute of KRC).

Various methodologies are under development in this category. However, we should all recognize that impacts will vary depending on the type of water flow, resources, locations and mode of use and should make an effort to harmonize the various methodologies to achieve more sophisticated assessment of water use/consumption.

4.4 Special session 4: decoupling environmental impact and resource use from economic growth in Asia

Asian economies are steadily expanding their business activities, a process attended by spiralling GHG emissions, growing resource consumption and a range of severe environmental problems relating to air, water and soil pollution and generation of waste. The aim of this special session, organized by Keisuke Nansai (NIES) and Seiji Hashimoto (NIES), was to provide an opportunity to discuss a strategic method for decoupling increases in environmental load and resource consumption from economic growth in Asian economies.

At this session, Junko Akagi (NIES) first reported on the GHG emissions and absorbed amounts of the 12 Asian

nations participating in the Workshop on GHG Inventories in Asia. She then went on to discuss current estimates and problems relating to accuracy, suggesting that improvement of the estimation methods used for agriculture and the LULUCF is important.

Next, the invited speaker Kejun Jiang (Energy Research Institute of China) reported on medium- to long-term economic growth in China, as estimated by IPAC modelling groups, and presented projections of energy consumption and GHG emissions based on these scenarios. He suggested that for China to reach a peak in GHG emissions by 2030 requires institutional policies such as carbon taxes and emissions trading, in addition to introduction of technical measures such as new energy conversion technologies, renewable energy and nuclear power. Although some of the new energy technologies of key importance for reducing China's net carbon emissions look set to be developed by countries other than China, when it comes to the development of clean coal technology (such as integrated coal gasification combined cycle), there is anticipated to be substantial latent demand in China. The speaker therefore stressed the importance of R&D in these fields. If China succeeds in becoming a world leader in environmental technology, it will provide major benefits to the country in both economic and environmental terms.

Chia-Wei Chao (Nat. Taiwan Univ.) analyzed the potential environmental impact of Taiwan's industrial activities and energy structure in 2020, using hybrid multi-regional Life Cycle Assessment (HMR-LCA) methods. Projections of economic output, industrial activity and technical scenarios were set based on a policy target related to low-carbon growth in Taiwan, with consideration also being given to the contributions of imports and exports. By 2020, the country may be seeing significant impacts on human health, as well as rises in water consumption and GHG emissions.

Next, William II Young Byun (Asia Renewables) presented a range of information and concrete examples indicating that if the growth of Asian economies is to be decoupled from environment burdens, it is essential for renewable energy resources such as biomass to be introduced in such a way as to stimulate regional economies and reduce regional environmental burdens, rather than adopting top–down strategies involving introduction of conventional centralized coal-fired power plant and similar large-scale installations.

Heinz Schandl (CSIRO) provided a projected estimate of materials consumption and resource efficiency in the Asia-Pacific region and its subregions. He also examined trends in resource use from 1970 to 2005 and presented scenarios for future resource use and efficiency pathways for 2030 and 2050. In an IPAT analysis with $I = \text{DMC}$ (Domestic Materials Consumption), $P = \text{Population}$, $A = \text{GDP/Capita}$

and $T = \text{DMC}/\text{GDP}$, he demonstrated that the contribution of A is significant for conventional I . He explained the difficulty of simultaneous accomplishment of two goals: alleviating poverty and reducing materials consumption. Furthermore, when full employment is secured in the future scenario, reducing materials consumption in the Asia-Pacific region is a constraint only if improving the efficiency of materials utilization is attempted.

Guan-Lin LU (Nat. Taipei Univ.) presented the results of an economy-wide MFA of the Taiwanese economy and measured indicators of resource productivity. He showed that although direct material input (DMI) continued to grow up to 2006, it took a downward turn after 2007, with the onset of the major recession. Observing historical changes in GDP/DMI , domestic processed output (DPO)/GDP, per capita DMI, per capita DPO and per capita GDP, he also referred to the Taiwanese economy as being characterized by a heavy reliance on exports.

Suthira Puangsiri (Chulalongkorn Univ.) reported on the volumes of materials now being recycled in Thailand following introduction of a Municipal Waste Banking System by local government and the resultant changes in environmental loads. Under this system, local residents can open a “waste account” for depositing income from selling recyclable wastes to community waste collection centres. The scheme has helped not only reduce the amount of waste for final disposal as well as environmental loads but also engender a new culture that is changing citizens’ attitudes towards refuse disposal and creating a livelier interest in and responsibility for the waste they produce.

Finally, using the Global Link Input–Output model, Nansai (NIES) quantified the GHG emissions induced by Japan both domestically and abroad. He presented and analyzed the structure of induced global GHG emissions for Japanese commodities with varying degrees of processing, giving due consideration to the role of international trade networks. He showed that the structure of induced global GHG emissions differs widely across commodities and stressed the need for correct prediction of changes in future commodity demand if GHG emissions are to be effectively reduced in Japan and abroad.

4.5 Special session 5: index and methods to assess socioeconomic impacts and sustainability

For some years now, LCA has been standardized and practiced as a common method for measuring the environmental impacts of goods and services. However, to attain truly sustainable patterns of production and consumption, many other aspects must also be taken into account, including not only environmental but also economic and social dimensions. In the coming decade, social impact assessment, socioeconomic analysis and sustainability

assessment using the lifecycle approach are thus expected to play an increasingly important role. This session, organized by Minako Hara (NTT Energy and Environment Systems Laboratories) and Hiroki Hondo aimed to provide a platform to discuss the development and application of indices and methods that assess technologies, products and services from economic and social perspectives.

The session consisted of six presentations. The invited speaker Matthias Finkbeiner gave the keynote presentation, entitled “Towards Life Cycle Sustainability Assessment – Integrating Social and Economic Aspects into Life Cycle Assessment”. He reviewed the international background of developing sustainability indices and presented the concept of a new sustainability index named the Life Cycle Sustainability Dashboard, which considers the impact of both environmental and socio-economic aspects. Guido Sonnemann (UNEP DTIE) introduced his organization’s activities on Social LCA, including an evaluation tool for resource management developed in the context of UNEP’s Life Cycle Initiative. Kazue I. Takahashi (NTT Corp.) presented a monetary social impact index named the Gross Social Feel-good Index, including the evaluation result for videoconferencing in Japan and France. Johanna Elisa Laaksonen (Aalto Univ.) introduced the concepts underlying her team’s work on developing a tool on decision-making on value chain management for department stores in Finland. Rika Eguchi (Keio Univ.) reported the results of a questionnaire-based benefit evaluation of health and well-being gained through the use of thermal insulation.

Given the emerging interest in socioeconomic assessment, both practical assessment tools and methodologies are needed to achieve appropriate linkage between environmental and socioeconomic issues. Socioeconomic assessment requires “bottom–up” approaches, including case studies, as presented, as well as “top–down” approaches, including standardization to build consensus.

4.6 Special session 6: international standardization of environmental management accounting

Material Flow Cost Accounting (MFCA) is a useful environmental management accounting tool that is used throughout the world. The general framework of MFCA has been the subject of an international standardization process since 2007 and is to be published in 2011 as ISO14051 of the ISO14000 family. At this special session, organized by Michiyasu Nakajima (Kansai Univ.), the main purpose was to discuss the future potential of MFCA in pursuit of sustainability. The presentations sought to demonstrate the practical and theoretical possibilities of Sustainability Management through an ISO process, with reference to several case studies and MFCA research. Bernd Wagner (Univ. of Augsburg), the invited speaker,

gave a presentation entitled “The Role of MFCA in Coping with the Challenges of 2020” in which he emphasized the role and potential of MFCA for achieving high performance on the “triple bottom line”. Of particular importance at this special session was Wagner’s statement that “Governing man-made material flows on a global level is vital for human existence on earth. MFCA is a tool to govern and control material flows and their economic, environmental and social effects on a sustainable international level. Today we are not yet in a position to globally limit the adverse environmental and social effects of material-based economic growth. However, we cannot wait. We can start on a microeconomic corporate level. By virtue of this support, individual corporate long-term survival and sustainability can in turn support development towards global material governance. We cannot predict our future, but we can identify conditions under which a future is possible—or not.”

This session comprised four other presentations, on the following topics: “The international standardization process and contents of ISO14051”, “Case study of corporate management by MFCA to promote material efficiency in the SEKISUI Chemicals Group”, “Case study of manufacturing management by MFCA, including supply chain management in OMRON” and “Modelling of sustainable management information by MFCA to use as internal and external corporate information”. MFCA has been used to improve the material efficiency of Japanese production processes, usually factory lines. By its very nature, though, MFCA has the potential to expand its scope and boundaries in the context of business management. The case study of SEKISUI Chemicals looked at MFCA as a corporate management tool to reduce waste and losses in business processes, to evaluate MFCA results as a performance indicator for corporate sustainable management, and to establish PDCA (plan-do-check-act) management by means of MFCA across a whole group of companies. The case study of OMRON discussed the introduction of MFCA to identify sites of material inefficiency (material losses in MFCA terms) in manufacturing processes, to expand MFCA analysis in supply chains to identify the causes of such losses, and to establish joint activities to reduce those losses, with closer communications down the supply chain.

These cases are examples of typical eco-innovations. Once ISO14051 has been published, these innovations can be promoted in business processes. We should develop new functions and capabilities of MFCA to promote achievement of sustainability by means of MFCA. Performance on the yardstick of MFCA will be able to serve as one indicator of sustainability in global society. MFCA can quantify the material efficiency of the processes used to produce products and services in the global marketplace, and thus provide a means of prioritizing action to improve

efficiency in this respect. During the discussion, future MFCA topics were illustrated.

Finally, we discussed the need for a robust strategy for achieving effective management of environmental sustainability using MFCA data, following publication of ISO14051 (MFCA), and for expanding MFCA thinking around the world. Our next opportunity to discuss this issue will be at the following ICEB.

4.7 Special session 7: applications of LCA to new-technology innovation

The earth’s climate has undergone dramatic changes since the mid-twentieth century and it is crucial to cut greenhouse gas emissions to less than half the current level to secure stabilization. One of the key pillars for establishing a low-carbon society is environment-related technological innovation.

For this session, organized by Rokuta Inaba (NIES) and Yasunari Matsuno (Univ. of Tokyo), papers were invited on application of LCA to new technologies, such as electric vehicles (EV), hybrid vehicles, new energy systems, information and communication technologies (ICT) and recycling technologies.

This session had 13 presentations divided into three broad categories. In the first part of the session, three studies were described concerned mainly with biomass utilization. Their themes were trend analysis in concepts of biomass utilization in Japanese municipalities; evaluation of several scenarios for the Norwegian forestry industry; and model analysis of complex systems relating to the German forestry industry. One of the key issues discussed in this first part were the social and economic factors surrounding the technological system.

In the second part, six studies addressing various new materials and technologies were presented. Their themes were: product system assessment with a case study on ICT; comparison of the environmental performance of “virtual meeting” solutions; impact assessment for composite materials employing carbon nanotubes; comparison of the environmental impacts of carbon capture and storage technologies; analysis of material flows and the value of waste electrical and electronic equipment and promotion of Composite LCA for technological innovations like hydrogen-based transportation. Important issues in this second part were: reconfirmation of functional units in the systems compared; interpretation of broad-bandwidth results deriving from data uncertainties; a comprehensive evaluation method for multiple impact categories; and fluctuating factors in material flows.

In the final part of this session, four studies were presented concerning application of LCA to eco-innovation technology, with the main focus on electric vehicles. In Japan, for example, EV has attracted major

interest, with commercial production of EV beginning in 2010. Presentations were given on application of LCA to EV by Renault Corp., as a report on a foreign case, and by Nissan Motor and AIST, as reports on Japanese cases. In addition, an analysis of the influence of EV introduction on the material flow of aluminium was presented by the Univ. of Tokyo. In the context of LCA of EV, it was reported that the environmental load could be reduced by reusing the lithium ion battery or by leasing it, because the load of the battery is high. In addition, the greatest mileage achievable on a single charge will vary according to battery capacity. Low capacity will generally reduce maximum mileage, but at the same time, the vehicle will be slightly lighter, reducing the environmental burden somewhat. In conventional LCA on internal combustion-engine cars, the functional unit is defined as “10 years/100,000 km operation in 10–15 modes”. It can be argued, however, that it may be better to define the functional unit simply as lifetime mileage and operation, with no consideration given to the best mileage achievable on a single battery charge. Given time constraints, this was an issue that could not be adequately explored and needs to be returned to on a subsequent occasion.

4.8 Special session 8: materials for raising consumer environmental awareness and promoting environmental consumer practices

Ecomaterials are materials for improving the eco-efficiency of products, defined as product performance divided by life-cycle environmental burden, and their development has helped improve product eco-efficiency. Despite the growing diffusion of eco-efficient products (“eco-products”) in Japan, however, consumer GHG emissions have continued to rise, and the implication is that GHG emissions need to be controlled not only through introduction of eco-products but also by engendering changes in the behaviour of their users. In this special session, organized by Yoshikazu Shinohara (NIMS), Japan, we discussed new aspects of ecomaterials from the perspective not only of product-makers but also eco-product users. This session, which included ten oral presentations, started with an opening talk by Shinohara, and was followed by two talks from the invited speakers Di Zhang (Shanghai Jiao Tong Univ.) from China and Osamu Umezawa (Yokohama Nat. Univ.) from Japan. Another invited talk was given by Bruno De Benedetti (Politecnico di Torino) from Italy. Hideki Abe (RIKEN), Seiji Hashimoto (NIES), Atsumi Furuya (Hokkaido Univ.) and Ichiro Daigo (Univ. of Tokyo) from Japan gave a presentation on new directions of ecomaterials. Jitti Mungklalasri (Nat. Metal and Materials Technology Center) from Thailand discussed interesting results on shopping bags, while Eirini Renata Dimitrakali (Univ. of Central Lancashire) from the UK gave an

impressive talk on how the construction industry can be “greened”. It was reconfirmed that communications among material-manufacturers, product-makers and users (citizens) is a key issue when it comes to new aspects of ecomaterials.

5 Closing ceremony

At the closing ceremony, the winners of the ICEB poster prize were announced. Following a two-tier selection process from among 112 poster presentations, three prizes were awarded: gold, silver and bronze.

In the first selection phase, presentations were peer-reviewed by the Executive Committee to select nominees for the second phase. In this double-blind peer-review process, the author’s name, status, e-mail address and all other references were blanked out. At the Poster Session on November 12, the 24 poster award judges comprehensively assessed the eight posters nominated for the second phase. Each judge evaluated six of the eight nominated posters and voted for a prize-worthy poster: 18 judges evaluated a poster that was nominated.

Meanwhile, nine people from the International Advisory Board, 11 from among the overseas invited speakers and session chairs and four Executive Board members of ILCAJ cooperated on the secondary selection. We express our sincere thanks to: Prof. Bruno De Benedetti, Dr. Marc-Andree Wolf, Mr. Mark J. Goedkoop, Dr. Martin Baitz, Dr. Rolf Frischknecht, Prof. Yuh-Ming Lee, Dr. Annette Koehler, Prof. Sangwon Suh, Prof. Shabbir H. Gheewala, Dr. Lise Laurin, Mr. Bastian Wittstock, Dr. Evan Griffing, Prof. David A. Vaccari, Prof. Hwong-wen Ma, Prof. Kejun Jiang, Prof. Di Zhang, Dr. Andreas Ciroth, Dr. Witold-Roger Pogonietz, Dr. Heinz Schandl, Dr. Jan Minx, Prof. Hirokazu Kato, Dr. Atsushi Terazono, Prof. Yasushi Kondo and Prof. Yasushi Umeda.

The winner of the Gold Poster Award received certificates and monetary awards, in addition to a plaque from Yuichi Moriguchi (NIES), Vice-president of ILCAJ. The Silver and Bronze Poster Awards were also accompanied by certificates and monetary awards.

The awardees and their contributions are as follows:

Gold Poster Award

Miyata N, Kikuchi Y, Hirao M; Scenario Analysis on Pulp and Paper Flow for the Design of Paper Recycling System, *Proceedings of the 9th International Conference on EcoBalance*, P-106 (in CD-ROM), Nov. 2010, Tokyo, Japan.

Silver Poster Award

Yamanari M, Adachi K, Dowaki K, Sadamichi Y; A System Analysis of Bio-ethanol Produced from Cassa-

va and Sugarcane in Northern Thailand, *Proceedings of the 9th International Conference on EcoBalance*, P-073 (on CD-ROM), Nov. 2010, Tokyo, Japan.

Bronze Poster Award

Goto Y, Kagawa S, Kudoh Y, Nansai K; Structural Decomposition Analysis of Automobile Gasoline Consumption and Sensitivity Analysis, *Proceedings of the 9th International Conference on EcoBalance*, P-114 (in CD-ROM), Nov. 2010, Tokyo, Japan.

Hiroki Hondo, Chair, presented a closing speech and expressed his gratitude to all participants. He anticipated

that the presentations and discussions of this conference and the new networks established among participants and organizations would be beneficial to the future research and business affairs of the participants. He again made an earnest appeal that in pursuing a sustainable future, it is extremely important that decision-making encompass trade-offs between events and activities of a widely varying nature and that such decision-making can best be based on a lifecycle thinking.

Finally, it was determined that the 10th ICEB organized by ILCAJ will be scheduled for 2012 and the conference closed with an invitation to renewed cooperation at that event.